

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

10'517145

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 9430wo/cf	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/SE2003/000933	International filing date (day/month/year) 05-06-2003	Priority date (day/month/year) 07-06-2002
International Patent Classification (IPC) or national classification and IPC B25J 9/00, B25J 9/18		
Applicant ABB AB ET AL		

- This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 5 sheets, including this cover sheet.
- This report is also accompanied by ANNEXES, comprising:
 - ☐ (sent to the applicant and to the International Bureau) a total of 2 sheets, as follows:
 - ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- | | | |
|-------------------------------------|--------------|---|
| <input checked="" type="checkbox"/> | Box No. I | Basis of the report |
| <input type="checkbox"/> | Box No. II | Priority |
| <input type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| <input type="checkbox"/> | Box No. IV | Lack of unity of invention |
| <input checked="" type="checkbox"/> | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/> | Box No. VI | Certain documents cited |
| <input type="checkbox"/> | Box No. VII | Certain defects in the international application |
| <input type="checkbox"/> | Box No. VIII | Certain observations on the international application |

Date of submission of the demand 22-12-2003	Date of completion of this report 09-09-2004
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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2003/000933

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☒ This report is based on a translation from the original language into the following language english, which is the language of a translation furnished for the purposes of:

- ☐ international search (under Rules 12.3 and 23.1(b))
☒ publication of the international application (under Rule 12.4)
☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:

pages 1-11 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished

pages* _____ as amended (together with any statement) under Article 19

pages* 1-2 received by this Authority on 2004-09-02

pages* _____ received by this Authority on _____

☒ the drawings:

pages 1-2 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing (specify): _____

☐ any table(s) related to the sequence listing (specify): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing (specify): _____

☐ any table(s) related to the sequence listing (specify): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2003/000933

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-11</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-11</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-11</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report

D1: US 5 241 250 A
D2: US 4 578 764 A
D3: US 5 274 781 A
D4: EP 0 338 117 A2
D5: EP 0 728 559 A2

D1 discloses a servomotor control system for multiaxes used for robots. The system comprises a servo-controller (18), a positioning controller (16) and a teaching box (14). This indicates that there must be one or more computer and drive unit in the system for controlling the robots. The system comprises several modules (14, 16, 18) where each module corresponds to independently control a servomotor simultaneously. The modules are arranged for connection to one another through a bus (17). A module can easily be added to expand the system (see column 4, lines 18-62; figure 1; abstract).

D2 discloses a control system for control of one or more manipulators. The system employs a computer (12) and one or more modules (20) for controlling the manipulator. The separate modules (12, 20) are adapted to handle different functions and are in communication with at least one of the other modules through a computer bus (14). The system can easily be expanded by additional of one or more modules (see column 1, lines 33-61; column 2 line 4 - column 3 line 4; figures 1-2; abstract).

D3 discloses a control system for controlling a machine. The

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

system comprises a computer (21) and one or more units (12, 13) with its own power supply (14, 15, 18) for controlling the machine. The units are adapted with one or more separate modules (14, 15, 16, 17) for performing different functions. Each unit provides separately power to the modules and communicates with at least one of the other unit through a data bus (13) and a cable (22) (see column 1, lines 11-21, column 2, lines 53-68; figures 1-2; abstract).

D4 discloses a pair of synchronised computer-controlled robotic machining centres capable of automatically working and operating in mirror relationship on opposite side of components to be assembled (see column 7, lines 8/51; figure 2; abstract).

D5 discloses a power supply system for industrial robot with drive mechanisms for moving manipulator in several degrees of freedom. Each drive mechanism has an electric driving motor (2) which is supplied and controlled via a rectifier (6) and a drive device (7) (see figure 3; abstract).

The invention according to claims 1-11 differs from what is known in D1 - D5 by a control system comprising a plurality of separate main computer modules adapted to handle various functions. Each module is autonomous and has its own well-defined interface with respect to the other modules, which may either be placed together or be geographically separated at suitable locations. An axis computer provides control signals to the drive units for controlling the manipulator, and a main computer is adapted to execute a program with instructions for the movements and that supplies the axis computer with control instructions. The separate modules, where each one of the modules is surrounded by its own casing, has its own power supply, computer, drive unit, and is adapted to communicate with at least one of the other modules.

The difference in this control system makes it possible to provide a flexible control system for control of one or more manipulators. It becomes easier to connect a new manipulator to the control system, to add a new function and to replace some part for upgrading the control system. It is easy for the control system to be divided into a plurality of separate modules with their own power supply, computer and drive unit

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
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adapted to handle various functions. If some errors would occur in the control system, the faulty module can simply be replaced. The teaching of the prior art as disclosed in the cited documents does not lead a skilled person to the invention. Therefore, the invention defined in the claims is not obvious to a person skilled in the art.

The invention according to claims 1-11 is thus novel and is considered to involve an inventive step. The invention also has industrial applicability.

CLAIMS

1. A control system for controlling one or more manipulators (2), wherein the control system comprises one or more
5 drives that control motors driving the movements of the manipulator, an axis computer (6) that provides control signals to the drives, and a main computer (4) that is adapted to execute a program with instructions for the movements and that supplies the axis computer with control
10 instructions, **characterized** in that the control system comprises a plurality of physically separated modules (12, 14, 16, 18, 20) adapted such that they can be placed at separated locations and to handle different functions, each of the modules is surrounded by a casing (15) of its own,
15 has its own power supply (26) and has a well-defined interface in relation to the other modules, wherein said computers (4, 6) and drives are arranged in the modules (9), and one of said modules is a main computer module (12), which comprises the main computer (4), and another of
20 said modules is a drive module (14), which comprises the axis computer (6).

2. A control system according to claim 1, **characterized** in that the control system comprises at least two separate
25 drive modules.

3. A control system according to claim 2, **characterized** in that each drive module (14) is adapted to control a manipulator (2).
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4. A control system according to any of claims 1-3, **characterized** in that said drive module (14) comprises a drive unit (8) that includes one or more drives.

35 5. A control system according to any of claims 1-4, **characterized** in that one of said modules is a transformer module (18) that includes a transformer.

6. A control system according to any of the preceding claims, **characterized** in that one of said modules is a control module (16) that comprises the control panel of the control system.

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7. A control system according to any of the preceding claims, **characterized** in that at least some of the modules are adapted to communicate via Ethernet.

10 8. A control system according to any of the preceding claims, **characterized** in that said manipulator is an industrial robot (2).

15 9. A control system according to any of the preceding claims, **characterized** in that the control system comprises at least three modules.

10. Use of a control system according to any of claims 1-9 for controlling an industrial robot.

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11. A method for controlling one or more manipulators (2), wherein the control system comprises drives that control motors driving the movements of the manipulator, an axis computer (6) that provides control signals to the drives, and a main computer (4) that is adapted to execute a program with instructions for the movements and that supplies the axis computer with control instructions, **characterized** in that said one or more computers and drives are arranged in physically separated modules (12, 14, 16, 18, 20), each of which has its own power supply (26) and a well-defined interface in relation to the other modules, wherein the axis computer and the main computer are arranged in separate modules and are brought to communicate with at least one of the other modules.

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